

## **APPENDIX J**

### **Hydrology**

In the 1950's, the Iowa State Highway Commission (now Iowa DOT) adapted Bureau of Public Roads' (now FHWA) Chart 1021.1, "Highway Drainage Manual," 1950. The Bureau of Public Roads' chart was adapted from original work performed by W.D. Potter, "Surface Runoff from Small Agricultural Watersheds," Research Report No. 11-B, (Illinois) Highway Research Board, 1950. The Iowa Runoff Chart has been widely used by Iowa DOT and the counties since then.

The chart is self-explanatory. However, its use does require the exercise of judgment in selecting the land use and land slope factors. It can be used for rural watersheds draining up to 1280 acres.

The following is intended to aid that judgment:

1. "Very Hilly Land" is best typified by the bluffs bordering the Mississippi and the Missouri rivers. This terrain is practically mountainous (for Iowa) in character. Small areas of very hilly land can be found in all parts of the state. Typically, they can be found near the edge of the flood plains of the major rivers.
2. "Hilly Land" is best typified by the rolling hills of south central Iowa. Interstate 35 in Clarke and Warren counties traverses many hilly watersheds. Small areas of hilly land can be found in all parts of the state.
3. "Rolling Land" is best typified by the more gently rolling farm lands of central Iowa. Interstate 80 in Cass and Adair Counties traverses many rolling watersheds. Small areas of rolling land can be found in all parts of the state.
4. "Flat Land" is best typified by the farm lands of the north central part of the state. US. 69 traverses many flat watersheds in Hamilton and Wright Counties. Small areas of flat land can be found in all areas of the state.
5. "Very Flat Land" is best typified by the Missouri River flood plain. Interstate 29 is located on this type of land for most of its length. Much of Dickinson, Emmet, Kossuth, Winnebago, and Palo Alto counties are also in this classification. Small areas of very flat land can be found in all parts of the state.

Use this chart only for rural watersheds and the limitations of drainage areas listed below. The equations shown below were developed by finding the best statistical fit to the curve on the Iowa Runoff Chart. At the larger drainage areas (600 to 1280 acres), the equation over estimates Q taken from the chart by up to 7%. In most cases, however, this would not result in a larger culvert size. If the designer questions the equation results, use the curve on the Chart. Be aware that error (overestimating or underestimating) may also result from interpolating the Q from the curve.

English equation:  $Q_{\text{design}} = LF \times FF \times Q$

For drainage areas,  $2 < A < 1280$  acres where

$$Q = 8.124 \times A^{0.739}$$

Q is in ft<sup>3</sup>/sec  
A is in acres

Metric equation:  $Q_{\text{design}} = LF \times FF \times Q$

For drainage areas,  $1 < A < 518$  hectares where

$$Q = 0.446 \times A^{0.740}$$

Q is in m<sup>3</sup>/sec  
A is in hectares

### Frequency Factors (FF)

Frequency, years	5	10	25	50	100
Factor, FF	0.5	0.7	0.8	1.0	1.2

### Land Use and Slope Description Factors (LF)

Land Use	Land Description				
	Very Hilly	Hilly	Rolling	Flat	Very Flat (no ponds)
Mixed Cover	1.0	0.8	0.6	0.4	
Permanent Pasture	0.6	0.5	0.4	0.2	0.1
Permanent Woods	0.1-11	0.25	0.2	0.1	0.05



